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CHEMICAL & ENGINEERING NEWS

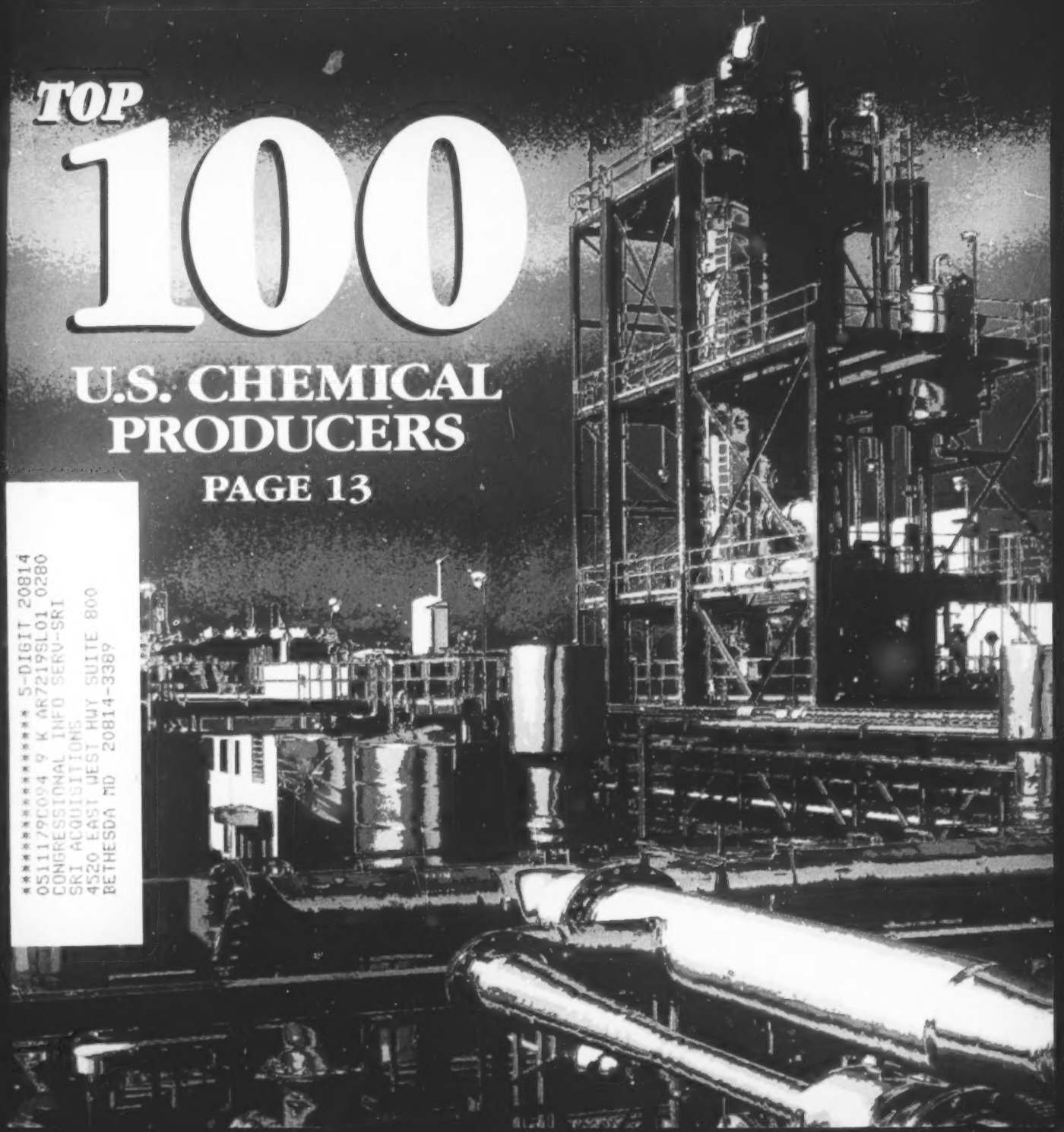
C&EN

MAY 9, 1994

MULTIMEDIA TOOLS ENHANCE CHEMISTRY PRESENTATIONS PAGE 34

TOP 100 U.S. CHEMICAL PRODUCERS

PAGE 13



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CHEMICAL & ENGINEERING NEWS
C&EN
MAY 9, 1994

NEWS OF THE WEEK

- Swiss-based Roche Holding announces plans to acquire U.S. drugmaker Syntex in a stock deal valued at $5.3 billion. **Page 4**
- Researchers detect fullerenes in a tiny impact crater on the surface of a spacecraft—the first direct observation of fullerenes in space. **Page 5**
- A series of science programs for children will air on public TV beginning this fall, as the result of an agreement signed by Walt Disney's Buena Vista Television and the Public Broadcasting Service. **Page 5**
- North Korea continues to reject demands for international inspection of spent nuclear fuel at its research reactor, raising fears of plutonium diversion to build nuclear weapons. **Page 6**
- ACS staff relocates to temporary offices in first step of $8.3 million total renovation of Washington, D.C., headquarters building, expected to take about a year. **Page 7**
- Clinton Administration announces five-year, $1.2 billion government-industry cost-shared program to boost U.S. production of flat-panel displays. **Page 7**

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BUSINESS

German chemical producers see signs their fortunes will improve in 1994—output and sales were up in the first quarter compared with the same period in 1993 in western Germany. **Page 19**

Aerosol industry had its second biggest year ever in 1993, topped only by 1992, despite a 1.6% slippage from 1992 in the number of units filled—2.94 billion. **Page 20**

GOVERNMENT

Superfund reform is resuscitated by consensus support from executives of key companies and community and environmental groups convened by the White House. **Page 23**

Edward David, Richard Nixon's ousted science adviser, recalls the tumult and the progressive aspects of that Administration and points out their similarities to Clinton's technology goals. **Page 25**

Environmental groups say the Administration's climate-change action plan will fall far short of its goal to reduce greenhouse gas emissions, claiming the plan is "full of hot air." **Page 28**

EDUCATION

Efforts to develop multimedia tools for chemistry presentations are producing materials with more sophistication and flexibility and are leading to more intense publishing activities. **Page 34**

PARSONS AWARD

Chemist, philanthropist Alfred Bader is to receive the 1995 Charles Lathrop Parsons Award for outstanding public service by a member of the American Chemical Society. **Page 41**

ACS NEWS

Fifty-year members of ACS are honored by local sections and the national society. **Page 44**

COVER STORY

Chemical sales of C&EN's Top 100 chemical producers were up only slightly in 1993 from the previous year, hampered by listless demand and sagging prices. **Page 13**

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Editor: Michael Heylin (202) 872-4501
Managing Editor: Madeleine Jacobs
Assistant Managing Editors: James H. Krieger, Janice R. Long, Rebecca L. Rawls, Donald I. Sotsson, William J. Storck
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LETTERS

Grignard reagents

I was interested to learn of the continuing work on the mechanism of formation of Grignard reagents, as reported by Stephen Stinson (C&EN, March 28, page 31).

Walter J. Bowyer's use of leuco crystal violet as an in-situ indicator for Grignard reagent is a valuable contribution to experimental methodology for studying this important heterogeneous reaction.

I wish to correct an error in Stinson's report. It is true that George M. Whitesides' group reached the same conclusion concerning the overall sequence and timing of the corrosion of magnesium during the course of its reaction with alkyl halides 15 years ago. It is important to note, however, that the bulk of the group's work was carried out while Whitesides was at Massachusetts Institute of Technology, not Harvard.

To my knowledge, I was the second-to-last student of Whitesides' to work on the Grignard problem (trapping of free alkyl radical intermediates by reaction with tetramethylpiperidine-*N*-oxyl [*J. Am. Chem. Soc.*, **111,** 5405 (1989)]; rate of reaction of cyclopentyl bromide with a rotating disk of magnesium [*J. Am. Chem. Soc.*, **103,** 5475 (1981)]). Alan Izumi (who also worked on the Grignard reaction) and I were involved in moving to Harvard from MIT in August 1982 and did work in the Mallinckrodt Laboratories there; however, we both received Ph.D.s from MIT. As far as I know, Whitesides has not actively worked on mechanistic organomagnesium chemistry for several years.

The previous experiments of Whitesides cited in Stinson's report were part of Craig L. Hill's doctoral research at MIT [*J. Org. Chem.*, **45,** 1020 (1980)]. Hill is currently on the faculty at Emory University. Among their scanning electron microscopy results: The type of corrosion pits formed is influenced by the history of the metallic surface (only surfaces that had been carefully polished to remove surface defects yielded hexagonal pits); corrosion pits in single-crystal magnesium also have variable morphology depending on whether an alkyl bromide (known to undergo reaction at a mass-transport-limited rate) or an alkyl chloride (known to react much more slowly) is used in the reaction (specifically—smooth, hemispherical pits are observed after reaction with alkyl bromide, while regular, hexagonal pits are seen upon reaction with alkyl chloride). Clearly, the nature of the halide influences the selectivity of Mg^{2+} removal from the metallic lattice; however, the relative importance of kinetic versus thermodynamic factors in the latter stages of the reaction between alkyl halides and magnesium is not yet well understood.

I have another comment regarding the implications of Bowyer's experiments. Although ferric chloride may be used to increase reactivity of the magnesium surface, it may not be an ideal additive. Iron and other transition metals are known to catalyze side reactions (generally resulting in alkane and olefin by-products [*J. Am. Chem. Soc.*, **111,** 5405 (1989)]), thereby potentially decreasing the yield of organomagnesium product.

Karen Root Caldwell
Norwich, N.Y.

Unethical terminations

It is incongruous at a time when mass terminations are becoming epidemic in the chemical industry that the ACS unit probing such cases is being discontinued (C&EN, April 11, page 45). As your article indicated, the dichotomy between what the employer and the employee consider to be voluntary separation is widening, with reconciliation of differing views making it almost impossible to ascertain the true situation during an investigation of the circumstances of termination.

Unfortunately, companies are becoming more knowledgeable in avoiding age discrimination suits. Recently, one company that had been rapidly expanding its research staff during the past several years suddenly resorted to a mass termination where the dismissal of long-term employees was balanced by that of recent employees to present a picture devoid of old-age discrimination. With this scenario, the recent employees not only were subjected to arbitrary dismissal, but after establishing themselves in the community by buying houses were terminated with less than two weeks of pay per year of service—a negligible amount considering that most of the individuals had been with the company less than five years.

When both recent employees and older employees—the former looking for a career and the latter with long records of meritorious service—are simultaneously dismissed, the question arises as to the effectiveness of laws designed to protect workers against old-age discrimination. Maneuvering by corporations intent on removing older employees and yet avoiding costly lawsuits has brought a bonanza to law firms representing these companies. The law and ethics diverge at this point.

Nelson Marans
Silver Spring, Md.

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Top 100 Chemical Producers Post Little Sales Growth

■ ***Combined sales of leading firms in 1993 were better than in previous few years, but barely up from 1992***

William J. Storck,
C&EN Northeast News Bureau

Last year may have been a better year than the previous few for the chemical industry, but it is not evident from the sales performance of the Top 100 U.S. chemical producers. Hampered by lackluster demand and weak prices in 1993, the leading chemical producers hardly eked out an increase in sales of their chemical products. Any improvement in earnings came from cost cutting and better operating efficiencies rather than from increases in business.

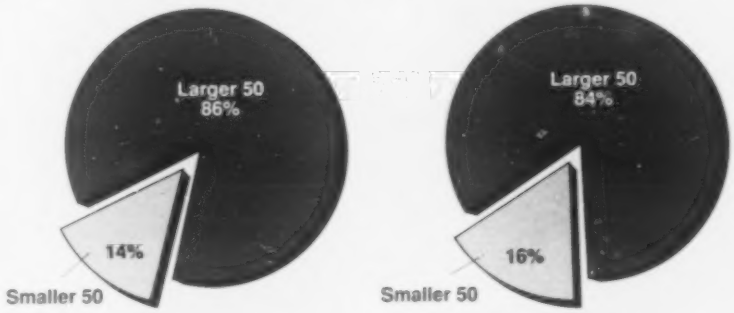
As a result, chemical sales for the Top 100 chemical producers last year totaled $183.4 billion. In 1992, the same companies had chemical sales of $183.0 billion. The sales increase might have been even smaller, had it not been for a pickup in consumer spending for big-ticket items such as automobiles and a rebound in housing sales in the second half of last year.

Although sales of the Top 100 companies increased little in 1993 over 1992, the $183.4 billion registered in 1993 was up from $181.0 billion for the slightly different list of companies that were included in the 1992 Top 100. And while 36 of the companies on the 1992 listing had sales declines, that number increased to 39 in 1993.

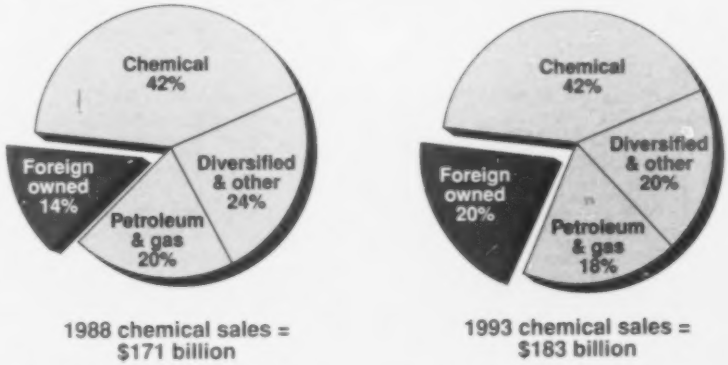
Companies on the 1993 list that were not included in 1992's are Huntsman Chemical, which, as a private company, had not provided data last year; Rexene, a Houston-based resins producer, which had been in a bankruptcy reorganization in 1992 and could not provide meaningful data for the 1992 ranking; Wellman, the fibers and plastics recycler and producer; Geon, the polyvinyl chloride producer spun off from BF Goodrich; Hanson, which owns SCM Chemicals and now Quantum; and Cytec, the chemicals spin-off from American Cyanamid. The largest company new to the listing for 1993 is ICI Americas, the U.S. arm of the U.K.'s ICI. The spin-off of ICI's agricultural chemicals and pharmaceuticals businesses into Zeneca has made ICI Americas pure enough in terms of chemical sales that it can now be ranked among the Top 100 U.S. producers.

There are still major chemical producers in the U.S. that are not included because either they do not break out chemical sales or they are privately held and do not report sales at all. Among the former group are such major companies as Procter & Gamble and 3M. And among the latter are J. M. Huber and PQ Corp.

In five years, the difference between sales by larger and smaller producers has changed little . . .



. . . but foreign-owned firms took a larger share from diversified and oil companies



Note: Based on chemical sales figures for Top 100 producers in 1993 and for those listed in C&EN, May 1, 1989, page 11.

Largest companies are most frequently hit by declining sales

Rank 1993	Rank 1992		Chemical sales 1993 ($ millions)	Change from 1992	Chemical sales as % of total sales	Industry classification	Chemical operating profits[a] ($ millions)	Change from 1992	Chemical operating profits as % of total profits	Operating profit margin[b]	Identifiable chemical assets ($ millions)	Chemical assets as % of total assets	Operating return on chemical assets[c]
1	1	DuPont	$15,603	0.4%	42.1%	Diversified	$750	–45.9%	51.7%	4.8%	$13,957	45.1%	5.4%
2	2	Dow Chemical	12,524	–3.1	69.3	Basic chemicals	773	30.6	53.7	6.2	12,530	49.1	6.2
3	3	Exxon	10,024	–5.7	9.2	Petroleum	636	–3.3	7.6	6.4	8,478	10.1	7.5
4	4	Hoechst Celanese	6,347	–2.3	92.0	Basic chemicals	561	26.9	155.8	8.8	na	na	na
5	5	Monsanto	5,651	5.0	71.5	Basic chemicals	731	17.5	90.2	12.9	5,312	61.5	13.8
6	7	General Electric[d]	5,042	3.9	8.3	Diversified	834	12.7	12.7	16.5	8,181	3.3	10.2
7	6	Union Carbide	4,640	–4.8	100.0	Basic chemicals	354	12.0	100.0	7.6	4,419	100.0	8.0
8	8	Occidental Petroleum	4,065	–3.8	47.6	Petroleum	184	100.0	84.8	4.5	5,780	33.8	3.2
9	9	BASF	4,037	–0.3	77.6	Basic chemicals	na	na	na	na	na	na	na
10	10	Eastman Chemical	3,903	2.4	100.0	Basic chemicals	476	–5.7	100.0	12.2	4,341	100.0	11.0
11	14	Shell Oil	3,875	18.2	18.6	Petroleum	328	89.6	23.0	8.5	4,312	16.1	7.6
12	12	Amoco	3,773	2.2	13.2	Petroleum	321	del	10.5	8.5	3,938	13.8	8.5
13	—	ICI Americas	3,565	20.0	100.0	Basic chemicals	188	45.7	100.0	5.3	na	na	na
14	11	Mobil	3,533	–4.6	5.5	Petroleum	25	–82.4	0.5	0.7	3,451	8.5	0.7
15	16	Rohm and Haas	3,269	6.7	100.0	Basic chemicals	267	–21.9	100.0	8.2	3,200	100.0	8.3
16	15	Arco Chemical	3,192	3.0	100.0	Basic chemicals	na	na	na	na	na	na	na
17	19	Miles	3,053	4.7	47.3	Diversified	na	na	na	na	na	na	na
18	18	Air Products[e]	2,906	3.6	87.3	Basic chemicals	417	–16.6	113.0	14.3	3,646	87.5	11.4
19	13	W. R. Grace	2,895	–16.7	65.7	Specialty chemicals	392	–9.9	103.2	13.5	2,115	39.5	18.5
20	21	AlliedSignal	2,791	7.3	23.6	Diversified	309	26.1	32.4	11.1	2,502	23.1	12.4
21	17	Chevron	2,708	–5.7	7.5	Petroleum	225	94.0	8.2	8.3	2,457	7.1	9.2
22	23	Ashland Oil[e]	2,586	3.9	25.4	Petroleum	108	12.5	36.4	4.2	958	17.3	11.3
23	22	Ciba-Geigy	2,519	–0.2	55.2	Specialty chemicals	na	na	na	na	na	na	na
24	20	Praxair	2,438	–6.4	100.0	Basic chemicals	341	23.6	100.0	14.0	3,255	100.0	10.5
25	26	Phillips Petroleum	2,308	3.7	18.8	Petroleum	97	148.7	9.1	4.2	2,011	18.5	4.8
26	27	Akzo	2,241	11.7	100.0	Basic chemicals	196	28.9	100.0	8.8	na	na	na
27	25	Rhône-Poulenc	2,200	–4.3	100.0	Specialty chemicals	na	na	na	na	na	na	na
28	29	Dow Corning	2,044	4.5	100.0	Specialty chemicals	236	11.9	100.0	11.5	3,265	100.0	7.2
29	35	Ethyl	1,938	14.5	100.0	Basic chemicals	168	–22.9	100.0	8.6	2,009	100.0	8.3
30	—	Huntsman Chemical	1,850	15.6	100.0	Basic chemicals	na	na	na	na	na	na	na
31	28	Hercules	1,843	–12.7	66.5	Basic chemicals	252	1.2	81.8	13.7	1,375	61.0	18.3
32	31	FMC	1,837	1.0	48.9	Machinery	197	–7.5	52.5	10.7	1,522	54.1	13.0
33	30	National Starch	1,808	–1.0	100.0	Specialty chemicals	288	3.3	100.0	15.9	1,672	100.0	17.2
34	36	Great Lakes Chemical	1,792	19.7	100.0	Specialty chemicals	415	15.0	100.0	23.2	1,901	100.0	21.8
35	34	Elf Atochem	1,700	0	100.0	Basic chemicals	na	na	na	na	na	na	na
36	38	Lubrizol	1,526	6.4	100.0	Specialty chemicals	190	2.6	100.0	12.5	1,055	89.2	18.0
37	24	American Cyanamid[d]	1,411	8.5	33.0	Specialty chemicals	na	na	na	na	na	na	na
38	40	Nalco Chemical	1,389	1.1	100.0	Specialty chemicals	263	1.0	100.0	18.9	1,212	100.0	21.7
39	39	Lyondell Petrochemical	1,326	–5.9	34.4	Petroleum products	57	–58.7	61.3	4.3	688	55.9	8.3
40	42	Morton International[f]	1,274	3.2	55.2	Specialty chemicals	135	–18.1	42.9	10.6	1,273	56.8	10.6
41	58	Witco	1,233	47.3	57.5	Specialty chemicals	108	45.7	94.5	8.8	1,037	56.4	10.4
42	45	Solvay America	1,200	4.4	100.0	Basic chemicals	na	na	na	na	na	na	na
43	44	Cabot[e]	1,192	0.9	73.8	Basic chemicals	149	–3.8	89.9	12.5	1,117	75.0	13.3
44	46	International Flavors	1,189	5.5	100.0	Specialty chemicals	na	na	na	na	na	na	na
45	47	PPG Industries	1,150	3.4	20.0	Glass products	138	–25.4	18.5	12.0	1,092	19.3	12.6
46	49	Olin	1,117	12.1	46.1	Basic chemicals	na	na	na	na	na	na	na
47	37	Texaco	1,114	–23.9	3.2	Petroleum	na	na	na	na	na	na	na
48	41	BP America	1,038	–19.8	6.6	Petroleum	26	–59.4	1.8	2.5	na	na	na
49	52	Henkel	1,010	14.6	100.0	Specialty chemicals	na	na	na	na	na	na	na
50	—	Cytec	1,008	–3.5	100.0	Basic chemicals	na	na	na	na	na	na	na

Rank 1993	Rank 1992		Chemical sales 1993 ($ millions)	Change from 1992	Chemical sales as % of total sales	Industry classification	Chemical operating profits[a] ($ millions)	Change from 1992	Chemical operating profits as % of total profits	Operating profit margin[b]	Identifiable chemical assets ($ millions)	Chemical assets as % of total assets	Operating return on chemical assets[c]
51	52	H. B. Fuller[d]	$975	4.5%	100.0%	Specialty chemicals	$54	–25.1%	100.0%	5.5%	$565	100.0%	9.5%
52	—	Geon	973	8.7	100.0	Basic chemicals	24	–384.7	100.0	2.5	721	100.0	3.4
53	50	Tenneco	914	–3.9	6.9	Diversified	83	6.4	6.7	9.1	721	4.7	11.5
54	—	Hanson	911	12.2	12.6	Diversified	na	na	na	na	na	na	na
55	51	Engelhard	910	–4.1	42.3	Diversified	137	7.2	81.5	15.0	788	61.6	17.4
56	57	Uniroyal Chemical	908	6.1	100.0	Specialty chemicals	110	0.1	100.0	12.1	1,225	100.0	8.9
57	54	CF Industries	906	0.8	100.0	Agrochemicals	–21	def	def	def	951	100.0	–6.7
58	48	IMC Fertilizer[e]	897	–15.2	100.0	Agrochemicals	19	–90.1	100.0	2.1	2,056	100.0	0.9
59	54	Farmland Industries[h]	893	–0.6	18.9	Agricultural supplies	49	–55.3	63.6	5.5	325	18.9	15.1
60	—	Wellman	842	1.7	100.0	Basic chemicals	76	–31.3	100.0	9.1	1,015	100.0	7.5
61	32	BF Goodrich	830	–53.3	45.6	Basic chemicals	53	92.0	62.6	6.4	687	29.1	7.7
62	62	CBI Industries	826	10.7	49.4	Construction	113	4.8	95.7	13.6	na	na	na
63	69	Arcadian Partners	799	34.8	100.0	Agrochemicals	69	–10.0	100.0	8.6	1,015	100.0	6.8
64	65	Fina	793	12.3	23.2	Petroleum	30	–39.4	117.3	7.6	402	16.0	15.0
65	59	Aristech	788	–1.4	100.0	Basic chemicals	na	na	na	na	na	na	na
66	61	Georgia Gulf	769	–1.4	100.0	Basic chemicals	111	–14.2	100.0	14.4	405	100.0	27.3
67	66	Vista Chemicals[f]	701	3.9	100.0	Basic chemicals	na	na	na	na	na	na	na
68	56	NL Industries	697	–22.0	86.6	Basic chemicals	36	–55.9	57.9	5.2	1,008	83.6	3.6
69	64	Betz Laboratories	685	–3.1	100.0	Specialty chemicals	101	–22.8	100.0	14.8	521	100.0	19.4
70	60	Freeport-McMoRan	619	–22.5	38.5	Agrochemicals	–56	def	def	def	1,194	32.2	–4.7
71	71	Sigma-Aldrich	613	10.8	82.9	Specialty chemicals	149	8.5	89.7	24.2	658	87.4	22.6
72	67	Loctite	613	0.8	100.0	Specialty chemicals	na	na	na	na	na	na	na
73	71	Kerr-McGee	556	8.0	16.9	Petroleum	70	–11.4	35.2	12.6	733	20.7	9.5
74	70	Intl. Specialty Products	548	–3.9	100.0	Specialty chemicals	65	–39.6	100.0	11.9	na	na	na
75	75	GenCorp	519	7.7	27.2	Rubber products	47	4.4	38.8	9.1	na	na	na
76	80	Sterling Chemical	519	20.5	100.0	Basic chemicals	15	–12.4	100.0	3.0	540	100.0	2.9
77	73	Union Camp	519	3.7	16.6	Diversified	49	56.9	23.1	9.4	385	8.2	12.7
78	68	Merck	510	–14.2	4.9	Drugs	na	na	na	na	na	na	na
79	73	Hüls America	500	0	100.0	Specialty chemicals	na	na	na	na	na	na	na
80	76	Aluminum Co. of America	479	0.7	5.3	Nonferrous metals	na	na	na	na	na	na	na
81	63	Unocal	460	–37.2	5.5	Petroleum	65	75.7	10.6	14.1	387	4.2	16.8
82	77	Ferro	449	–4.2	42.1	Specialty materials	24	20.2	24.9	5.3	238	37.2	10.0
83	79	Stepan	439	0.7	100.0	Specialty chemicals	20	–35.7	100.0	4.5	300	100.0	6.5
84	82	Borden Chemicals	433	7.8	100.0	Basic chemicals	17	–63.9	100.0	3.8	444	100.0	3.7
85	—	Rexene	429	3.5	100.0	Basic chemicals	15	34.2	100.0	3.4	430	100.0	3.4
86	85	Lonza	420	10.5	100.0	Specialty chemicals	na	na	na	na	na	na	na
87	83	Crompton & Knowles	407	3.1	73.0	Specialty chemicals	68	7.3	72.4	16.7	282	77.6	24.2
88	79	Mallinckrodt	395	–10.3	22.0	Specialty chemicals	na	na	na	na	na	na	na
89	81	Sun Co.	389	–5.7	4.2	Petroleum	na	na	na	na	na	na	na
90	84	Vulcan Materials	377	–3.8	33.2	Nonmetallic minerals	17	–66.1	12.9	4.6	na	na	na
91	87	Petrolite[f]	333	10.3	94.5	Specialty chemicals	30	21.7	94.1	8.9	259	86.0	11.5
92	81	Mississippi Chemical	289	20.6	74.8	Farm cooperative	23	–27.7	473.5	7.8	287	89.4	7.9
93	86	First Mississippi[f]	285	–9.3	66.3	Agrochemicals	38	–4.6	155.8	13.2	168	50.7	22.5
94	88	Calgon Carbon	269	–9.7	100.0	Basic chemicals	33	–29.2	100.0	12.3	337	100.0	9.8
95	90	Georgia-Pacific	267	11.3	2.2	Wood products	na	na	na	na	na	na	na
96	89	Agricultural Minerals	260	6.7	100.0	Agrochemicals	53	–5.3	100.0	20.4	286	100.0	18.5
97	100	Terra Industries	229	82.4	18.5	Agrochemicals	29	93.9	58.5	12.5	na	na	na
98	93	Nova	222	–1.4	100.0	Basic chemicals	na	na	na	na	na	na	na
99	95	Cambrex Corp.	197	9.9	100.0	Specialty chemicals	17	20.4	100.0	8.4	167	100.0	10.0
100	94	Quaker Chemical	195	–8.2	100.0	Specialty chemicals	17	–8.5	100.0	8.5	133	78.0	12.5

a Operating profit is sales less administrative expenses and cost of sales. **b** Chemical operating profit as a percentage of sales. **c** Chemical operating profit as a percentage of identifiable chemical assets. **d** Chemical sales include significant amounts of nonchemical products. **e** Fiscal year ended Sept. 30. **f** Fiscal year ended June 30. **g** Fiscal year ended Nov. 30. **h** Fiscal year ended Aug. 31. **i** Fiscal year ended Oct. 31. **na** = not available. **def** = deficit.

Chemical sales, operating profits, assets, and profitability rankings for Top 100 chemical producers

	Chemical sales			Chemical operating profits			Chemical operating profit margin			Identifiable chemical assets			Return on chemical assets		
		Rank			Rank			Rank			Rank			Rank	
$ Millions	1993	1993	1992	1993	1993	1992	1993	1993	1992	1993	1993	1992	1993	1993	1992
Agricultural Minerals	$ 260	96	89	$ 53	50	56	20.4%	3	4	$ 286	59	63	18.5%	8	11
Air Products	2,906	18	18	417	8	6	14.3	11	11	3,646	11	10	11.4	26	21
Akzo	2,241	26	27	196	23	32	8.8	37	62	na	—	—	na	—	—
AlliedSignal	2,791	20	21	309	15	20	11.1	29	49	2,502	16	16	12.4	23	38
Aluminum Co. of America	479	80	76	na	—	—	na	—	—	na	—	—	na	—	—
American Cyanamid	1,411	37	24	na	—	16	na	—	43	na	—	21	na	—	17
Amoco	3,773	12	12	321	14	—	8.5	42	—	3,938	10	—	8.2	43	—
Arcadian Partners	799	63	69	69	43	50	8.6	41	29	1,015	34	49	6.8	51	24
Arco Chemical	3,192	16	15	na	—	8	na	—	20	na	—	9	na	—	28
Aristech	788	65	59	na	—	—	na	—	—	na	—	—	na	—	—
Ashland Oil	2,586	22	23	108	36	45	4.2	64	72	958	37	39	11.3	27	47
BASF	4,037	9	9	na	—	—	na	—	—	na	—	—	na	—	—
Betz Laboratories	685	69	64	101	38	33	14.8	9	8	521	48	53	19.4	7	5
Borden Chemicals	433	84	82	17	67	59	3.8	66	43	444	49	54	3.7	56	45
BP America	1,038	48	41	26	60	53	2.5	69	67	na	—	—	na	—	—
Cabot	1,192	43	44	149	28	28	12.5	20	26	1,117	30	35	13.3	18	26
Calgon Carbon	269	94	88	33	57	58	12.3	23	16	337	55	58	9.8	35	25
Cambrex Corp.	197	99	95	17	67	77	8.4	45	57	167	64	67	10.0	33	49
CBI Industries	826	62	62	113	33	42	13.6	15	21	na	—	40	na	—	35
CF Industries	906	57	54	–21	73	49	def	—	54	951	38	43	def	—	44
Chevron	2,708	21	17	225	21	37	8.3	46	71	2,457	17	14	9.2	38	61
Ciba-Geigy	2,519	23	22	na	—	—	na	—	—	na	—	—	na	—	—
Crompton & Knowles	407	87	83	68	44	54	16.7	5	15	282	60	60	24.2	2	7
Cytec	1,008	50	—	na	—	—	na	—	—	na	—	—	na	—	—
Dow Chemical	12,524	2	2	773	2	5	6.2	53	68	12,530	2	2	6.2	53	60
Dow Corning	2,044	28	29	236	20	23	11.5	28	46	3,265	13	17	7.2	50	47
DuPont	15,603	1	1	750	3	1	4.8	59	52	13,957	1	1	5.4	54	46
Eastman Chemical	3,903	10	10	476	7	—	12.2	24	—	4,341	8	—	11.0	28	—
Elf Atochem	1,700	35	34	na	—	—	na	—	—	na	—	—	na	—	—
Engelhard	910	55	51	137	31	36	15.0	8	24	788	39	42	17.4	12	17
Ethyl	1,938	29	35	168	27	21	8.6	40	31	2,009	21	26	8.3	40	20
Exxon	10,024	3	3	638	5	3	6.4	51	63	8,478	3	3	7.5	48	56
Farmland Industries	893	59	54	49	52	40	5.5	54	38	325	56	59	15.1	15	1
Ferro	449	82	77	24	62	72	5.3	56	69	238	62	64	10.0	33	53
Fina	793	64	65	60	47	44	7.6	49	22	402	52	51	15.0	16	13
First Mississippi	285	93	86	38	55	61	13.2	17	33	168	63	66	22.5	4	6
FMC	1,837	32	31	197	22	22	10.7	30	41	1,522	24	25	13.0	19	22
Freeport-McMoRan	619	70	60	–56	74	76	def	—	77	1,194	29	33	def	—	69
H. B. Fuller	975	51	52	54	49	52	5.5	54	58	565	46	48	9.5	36	28
GenCorp	519	75	75	47	54	60	9.1	33	50	na	—	—	na	—	—
General Electric	5,042	6	7	834	1	2	16.5	6	19	8,181	4	4	10.2	32	50
Geon	973	52	—	24	62	—	2.5	69	—	721	41	—	3.4	58	—
Georgia Gulf	769	66	61	111	34	34	14.4	10	14	405	51	56	27.3	1	3
Georgia-Pacific	267	95	90	na	—	—	na	—	—	na	—	—	na	—	—
BF Goodrich	830	61	32	53	50	69	6.4	51	79	687	44	28	7.7	46	66
W. R. Grace	2,895	19	13	392	10	10	13.5	16	35	2,115	18	15	18.5	8	14
Great Lakes Chemical	1,792	34	36	415	9	11	23.2	2	2	1,901	22	—	21.8	5	—
Hanson	911	54	—	na	—	—	na	—	—	na	—	—	na	—	—
Henkel	1,010	49	52	na	—	—	na	—	—	na	—	—	na	—	—
Hercules	1,843	31	28	252	19	19	13.7	14	40	1,375	25	22	18.3	10	19

$ Millions	Chemical sales	Rank		Chemical operating profits	Rank		Chemical operating profit margin	Rank		Identifiable chemical assets	Rank		Return on chemical assets	Rank	
	1993	1993	1992	1993	1993	1992	1993	1993	1992	1993	1993	1992	1993	1993	1992
Hoechst Celanese	$6,347	4	4	$561	6	9	8.8%	37	60	na	—	—	na	—	—
Hüls America	500	79	73	na	—	—	na	—	—	na	—	—	na	—	—
Huntsman Chemical	1,850	30	—	na	—	—	na	—	—	na	—	—	na	—	—
ICI Americas	3,565	13	—	188	25	—	5.3	56	—	na	—	—	na	—	—
IMC Fertilizer	897	58	48	19	66	24	2.1	71	10	$2,056	19	20	0.9%	62	37
International Flavors	1,189	44	46	na	—	17	na	—	3	na	—	31	na	—	7
Intl. Specialty Products	548	74	70	65	45	42	11.9	27	5	na	—	—	na	—	—
Kerr-McGee	556	73	71	70	42	48	12.6	19	17	733	40	44	9.5	36	39
Loctite	613	71	67	na	—	38	na	—	—	na	—	50	na	—	10
Lonza	420	86	85	na	—	—	na	—	—	na	—	—	na	—	—
Lubrizol	1,526	36	38	190	24	25	12.5	20	29	1,055	32	41	18.0	11	7
Lyondell Petrochemical	1,326	39	39	57	48	30	4.3	63	48	688	43	—	8.3	40	—
Mallinckrodt	395	88	79	na	—	—	na	—	—	na	—	—	na	—	—
Merck	510	78	68	na	—	47	na	—	23	na	—	47	na	—	22
Miles	3,053	17	19	na	—	—	na	—	—	na	—	—	na	—	—
Mississippi Chemical	289	92	81	23	64	65	7.8	48	26	287	58	61	7.9	45	39
Mobil	3,533	14	11	25	61	29	0.7	72	73	3,451	12	11	0.7	63	62
Monsanto	5,651	5	5	731	4	4	12.9	18	42	5,312	6	6	13.8	17	28
Morton International	1,274	40	42	135	32	27	10.6	31	24	1,273	26	30	10.6	29	27
Nalco Chemical	1,389	38	40	263	18	18	18.9	4	5	1,212	28	29	21.7	6	11
National Starch	1,808	33	30	288	16	14	15.9	7	17	1,672	23	23	17.2	13	16
NL Industries	697	68	56	36	56	39	5.2	58	37	1,008	36	27	3.6	57	57
Novo	222	98	93	na	—	—	na	—	—	na	—	—	na	—	—
Occidental Petroleum	4,065	8	8	184	26	46	4.5	61	76	5,780	5	5	3.2	60	68
Olin	1,117	46	49	na	—	—	na	—	—	na	—	38	na	—	—
Petrolite	333	91	87	30	58	71	8.9	36	56	259	61	65	11.5	24	33
Phillips Petroleum	2,308	25	26	97	39	63	4.2	64	78	2,011	20	19	4.8	55	67
PPG Industries	1,150	45	47	138	30	25	12.0	26	13	1,092	31	37	12.6	21	15
Praxair	2,438	24	20	341	12	15	14.0	13	47	3,255	14	12	10.5	30	54
Quaker Chemical	195	100	94	17	67	73	8.5	42	55	133	65	68	12.5	22	31
Rexene	429	85	—	15	71	—	3.4	67	—	430	50	—	3.4	58	—
Rhône-Poulenc	2,200	27	25	na	—	—	na	—	—	na	—	—	na	—	—
Rohm and Haas	3,269	15	16	267	17	12	8.2	47	45	3,200	15	13	8.3	40	35
Shell Oil	3,875	11	14	328	13	—	8.5	42	—	4,312	9	—	7.6	47	—
Sigma-Aldrich	613	71	71	149	28	31	24.2	1	1	658	45	52	22.6	3	4
Solvay America	1,200	42	45	na	—	—	na	—	—	na	—	—	na	—	—
Stepan	439	83	79	20	65	65	4.5	61	59	300	57	62	6.5	52	42
Sterling Chemical	519	75	80	15	71	73	3.0	68	70	540	47	46	2.9	61	63
Sun Co.	389	89	81	na	—	—	na	—	—	na	—	—	na	—	—
Tenneco	914	53	50	83	40	81	9.1	33	—	721	41	45	11.5	24	—
Terra Industries	229	97	100	29	59	—	12.5	20	—	na	—	—	na	—	—
Texaco	1,114	47	37	na	—	80	na	—	—	na	—	—	na	—	—
Union Camp	519	75	73	49	52	65	9.4	32	63	385	54	57	12.7	20	51
Union Carbide	4,640	7	6	354	11	13	7.6	49	61	4,419	7	7	8.0	44	58
Uniroyal Chemical	908	56	57	110	35	40	12.1	25	31	1,225	27	34	8.9	39	52
Unocal	460	81	63	65	45	64	14.1	12	66	387	53	55	16.8	14	55
Vista Chemicals	701	67	66	na	—	—	na	—	—	na	—	—	na	—	—
Vulcan Materials	377	90	84	17	67	57	4.6	60	26	na	—	—	na	—	—
Wellman	842	60	—	76	41	—	9.1	33	—	1,015	34	—	7.5	49	—
Witco	1,233	41	58	108	36	51	8.8	37	52	1,037	33	36	10.4	31	58

Note: There are 74 companies ranked for operating profit, 72 for operating profit margins, 65 for chemical assets, and 63 for return on chemical assets. **na** = not available. **def** = deficit.

Firms that are classified as chemical companies—that is, with 50% or more of sales coming from chemicals—made up 42% of the sales of the total 100 in 1993, the same percentage as for the 1992 ranking. But perhaps because of the inclusion of ICI Americas, foreign-owned firms—most of which could be classified as chemical companies—now account for 20% of the total sales of the Top 100, up from 16% in the 1992 ranking. The increase in the share held by the U.S. units of foreign companies came at the expense of oil and gas producers that also make chemicals, which dropped from 21% to 18%, and the diversified and other category, which fell from 21% to 20%. In the past five years, the foreign-owned share has risen from 14%, while the share from the oil companies has dropped from 20% and that from the diversifieds fell from 24%.

In terms of the sales ranking for the chemical producers, there was little change in the top 10 list, with DuPont still in first place. All of the top 10 companies for 1993 were in the top 10 in the 1992 listing, although General Electric and Union Carbide switched places, with GE rising to sixth place from seventh and Union Carbide falling to seventh from sixth.

However, since GE's sales, published in its annual report as "materials," include significant amounts of nonchemical products, its chemical sales probably are, in actuality, lower than Carbide's.

The reliance on annual reports for chemical sales data causes some problems. For instance, while chemical sales for some companies such as GE and American Cyanamid are overstated, sales for some other companies like PPG Industries and Witco are probably understated.

Annual reports are also used for the subsidiary rankings for operating profits, chemical assets, and profitability, and this year a number of companies—many with high profitability—did not respond to requests for annual reports and thus are not included in these rankings. Among these companies are International Flavors & Fragrances, which had ranked third in operating profit margin in the 1992 listing; Arco Chemical; Loctite; and Mallinckrodt, which recently changed its name from Imcera.

Among the rankings other than that for sales, GE took first place for chemical operating profits with $834 million. GE was followed by Dow Chemical ($773 million), DuPont ($750 million), Monsanto ($731 million), and Exxon ($638 million).

For operating profit margin, the leader was Sigma-Aldrich (24.2%), followed by Great Lakes Chemical (23.2%), Agricultural Minerals (20.4%), Nalco Chemical (18.9%), and Crompton & Knowles (16.7%).

As it did for sales, DuPont took first place in chemical assets with almost $14.0 billion. Dow was in second place with $12.5 billion in assets, followed by Exxon with about $8.48 billion, GE with $8.18 billion, and Occidental Petroleum with $5.78 billion.

Georgia-Gulf had the best return on chemical assets at 27.3%. This was followed by Crompton & Knowles (24.2%), Sigma-Aldrich (22.6%), First Mississippi (22.5%), and Great Lakes Chemical (21.8%). □

Problems.